

rejections are respectfully submitted to be obviated in view of the amendments and remarks presented herein.

In the present Amendment, claims 120, 125, 130, 135, and 140 have been amended in response to the rejection under § 112, second paragraph. Each of claims 120, 125, 130, 135, and 140 is now consistent with claim 1 as amended in Applicant's Preliminary Amendment filed June 14, 2002. Reconsideration and withdrawal, therefore, of the rejection under § 112, second paragraph, are respectfully requested.

35 U.S.C. § 112, First Paragraph

Claim 66 remains rejected under 35 U.S.C. § 112, first paragraph. The Office Action again asserts that "[t]he 'processor' (claim 53) for particular use in a 'camera' is unclear from the specification (page 19)." The Office Action includes no response to Applicant's arguments of record for the allowability of claim 66.

As explained in Applicant's previous responses, Applicant respectfully submits that the meaning of the claimed "processor" (claim 53) for use in a "camera" (claim 66) would be evident to any person skilled in the art from the context of the disclosure at specification page 18, line 28, through page 19, line 21. Applicant discloses that "[t]he illustrated system is exemplary of a device having digital circuits which include CMOS imager devices," and that "[o]ther types of processor systems which include the same or similar systems of FIG. 11 include cameras, scanners, machine vision systems . . ."

Applicant submits that it would be abundantly clear to any person skilled in the art that the “processor” required for use in the claimed camera is a means for executing instructions, or programs having instructions, often known as a central processing unit (CPU), or often simply described as a “processor.” Secondly, the meaning of a processor for use in a camera would be clear from the background disclosure at specification page 4, line 26, through page 5, line 3, where Applicant discloses, for example, the description in Nixon et al., “256 x 256 CMOS Active Pixel Sensor Camera-on-a-Chip,” IEEE Journal of Solid-State Circuits, Vol. 31(12) pp. 2046-2050, 1996. The “processor” required for use in the claimed camera is a means for executing instructions, or for executing programs having instructions, that functions to operate the camera.

Claim 53 defines a system that comprises, *inter alia*, a “processor for processing image data.” Claim 66 defines the “system” of claim 53 to be a “camera.” Applicant relies upon the Nixon reference simply to establish that the meaning of a processor for use in a camera would be readily understood by one skilled in the art, and that no further description of such an embodiment is required to enable one to practice the invention.

Reconsideration and withdrawal, therefore, of the rejection of claim 66 under § 112, first paragraph, are respectfully requested.

35 U.S.C. § 102 – Anagnostopoulos

Claims 1-4, 7-13, and 120 stand rejected under 35 U.S.C. § 102 as allegedly being anticipated by U.S. Patent No. 5,804,845 to Anagnostopoulos et al. (hereinafter “Anagnostopoulos”). The Office Action asserts that “[t]he ‘nitrogen containing second insulating’ layer reads on an ONO layer or NO layer as in Anagnostopoulos et al.”; that “[t]he ‘first’ and ‘second’ gate stacks read on electrodes 32 with ‘photogate’ 30”; that “[f]or claim 2, as an alternative, in Figures 3B, 3C, the ‘first’ and ‘second’ gate stacks read on electrodes 30 with ‘photogate’ 32”; and that “[t]he ‘first’ insulating layer reads on silicon oxide layer 36 (Figure 3A), on ONO layer or layer 43 (Figure 3B), and on NO layer or layer 52 (Figure 3C).”

Applicant respectfully disagrees. None of the embodiments of Anagnostopoulos relied upon in the Office Action (Figs. 3A, 3B, and 3C) anticipates Applicant’s claimed invention, which includes both a first insulating layer disposed beneath each of the first and second gate stacks, and a nitrogen containing *second* insulating layer *in contact with the substrate* and beneath said photogate.

Each of Anagnostopoulos’ Figs. 3A, 3B, and 3C depicts a structure having a single insulating layer. For example, the structure depicted in Anagnostopoulos’ Fig. 3A has an ONO stack “formed by nitride layer 34, top oxide layer 35, and bottom oxide layer 36” (column 5, lines 2-3). As is evident from Fig. 3A, the ONO stack lies beneath the ITO electrodes 30, and the bottom oxide layer 36 portion of the ONO stack also lies beneath the

polysilicon electrodes 32. The Office Action's assertion that "[t]he 'nitrogen containing second insulating' layer reads on an ONO layer or NO layer as in Anagnostopoulos et al." is incorrect for at least the following reason. Anagnostopoulos' Fig. 3A embodiment does not have both "a first insulating layer in contact with said substrate and beneath each of said first and second gate stacks" and "a nitrogen containing *second* insulating layer *in contact with said substrate* and beneath said photogate," as claimed. See Applicant's Fig. 10, where both first insulating layer 315 and nitrogen containing *second* insulating layer 330 are in contact with the substrate. Anagnostopoulos does not teach this feature of Applicant's claimed invention.

Similarly, in the structure depicted in Anagnostopoulos' Fig. 3B, the entire ONO stack lies beneath both electrodes. In fact, Anagnostopoulos even explicitly states as much, to wit: "Here, ITO electrodes 30 and polysilicon electrodes 32 are formed upon an ONO stack comprising three layers that completely run beneath the electrodes" (emphasis added) (column 5, lines 15-17). But, Anagnostopoulos' Fig. 3B embodiment does not have both "a first insulating layer in contact with said substrate and beneath each of said first and second gate stacks" and "a nitrogen containing *second* insulating layer *in contact with said substrate* and beneath said photogate," as claimed. (See Applicant's Fig. 10.)

And, the prior art disclosed in Anagnostopoulos' Fig. 3C discloses that SiO₂ layer 52 is located between the substrate and the nitride layer 51. There is no teaching of both "a first insulating layer in contact with said substrate and beneath each of said first and second gate stacks" and "a nitrogen containing *second* insulating layer *in contact with said substrate* and beneath said photogate," as claimed.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-4, 7-13, and 120 under § 102 are respectfully requested.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki

Claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41, 44, 46, 51, 53-55, 57-59, 66, 115-124, and 135-139 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over “the acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki et al., considered together.”

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

The claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

With regard to Applicant’s claim 1, the asserted combination fails to suggest Applicant’s claimed imaging device comprising a “nitrogen containing second insulating layer in contact with said substrate and beneath said photogate.”

It is respectfully submitted that the disclosure of Nagasaki cannot compensate for the deficiency of “the acknowledged prior art.” Nagasaki discloses a solid-state imaging device containing an insulating film made of “a high dielectric material having a *high* relative dielectric constant” (column 11, lines 20-22)(emphasis added). The Office Action suggests

that from Nagasaki (Figure 17; columns 2-3) it would have been obvious to use an insulator with a higher dielectric constant in order to increase the capacity of the photogate.

However, while Nagasaki teaches the use of a high dielectric material, it also specifically teaches that silicon oxide and silicone nitride are *low* dielectric constant materials, while antiferroelectrics and ferroelectrics are high dielectric materials (column 3, lines 20-28). Nagasaki then proceeds to unequivocally and repeatedly exclude the use of low dielectric materials, including silicone oxide and silicone nitride, in its invention (column 4, line 57; column 5, line 42; column 6, line 33; column 6, lines 57-59; etc.)

As established above, by teaching the use of a material having a *high* relative dielectric constant, Nagasaki clearly teaches away from using nitrogen containing insulating materials. Nagasaki thus teaches away from Applicant's claimed invention. From the teaching of Nagasaki, therefore, it is not plausible to suggest that one of ordinary skill in the art would have used Applicant's claimed nitrogen containing material in place of a silicon oxide.

The Office Action asserts that it would have been obvious to use an insulator with a higher dielectric constant to increase the capacity of the photogate. No reference is cited, however, which suggests the use of a nitrogen containing insulating layer in the location claimed. Nagasaki does not teach or suggest that a nitrogen containing insulating layer would be useful for any purpose in the location claimed, much less to achieve the improved signal acquisition, wider dynamic range, and improved signal to noise ratio discussed, for example, at page 13, lines 10-20, and page 18, lines 20-24, of the specification.

Nagasaki *teaches* the use of “a high dielectric material having a *high* relative dielectric constant” (column 1, lines 65-66). In Table 1 (column 3), Nagasaki discloses that “SiO₂” is a “low dielectric material” with a relative dielectric constant of 4.5, and that “Si₃N₄” is a “low dielectric material” with a relative dielectric constant of 10. Every other entry in Table 1, none of which includes nitrogen, is described as a “high dielectric material.”

Therefore, simply because Si₃N₄ has a higher relative dielectric constant than SiO₂ does not mean that the nitrogen containing Si₃N₄ would be acceptable to Nagasaki. Nagasaki teaches the use of “a high dielectric material having a *high* relative dielectric constant,” and the only nitrogen containing material in Table 1, Si₃N₄, is described by Nagasaki as being “a *low* dielectric material.”

Thus, the asserted combination would not have rendered obvious the various embodiments of the invention defined by any of Applicant’s rejected independent claims. The rejected dependent claims are allowable along with the aforementioned independent claims, and on their own merits.

Claim 14 recites an “imaging device including a semiconductor integrated circuit substrate . . . comprising . . . a nitrogen containing insulating material in contact with said substrate and beneath said photogate.” Applicant submits that claim 14 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 15, 18, 19, 25, 26, and 116 are dependent upon claim 14, and contain all the limitations of claim 14. Claims 15, 18, 19, 25, 26, and 116 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 14, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Claim 28 recites “an imaging system comprising . . . wherein a nitrogen containing insulating layer is in contact with said substrate and beneath said photogate.” Applicant submits that claim 28 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 29, 31-33, 38, and 117 are dependent upon claim 28, and contain all the limitations of claim 28. Claims 29, 31-33, 38, and 117 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 28, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Claim 39 recites “an imaging system . . . wherein a nitrogen containing insulating layer is in contact with said substrate and beneath said photogate.” Applicant submits that claim 39 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 41-44, 51, and 118 are dependent upon claim 39, and contain all the limitations of claim 39. Claims 41-44, 51, and 118 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 39, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Claim 53 recites a “system comprising . . . a CMOS imaging device . . . including . . . a nitrogen containing insulating layer in contact with said substrate and beneath said photogate.” Applicant submits that claim 53 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 54-55, 57-59, and 119 are dependent upon claim 53, and contain all the limitations of claim 53. Claims 54-55, 57-59, and 119 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 53, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41, 44, 46, 51, 53-55, 57-59, 66, 115-124, and 135-139 under § 103 are respectfully requested.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki, with Koike

Claims 4, 27, 45, 56, 125-134 and 140-144 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki et al., further considered together with Koike et al.

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Furthermore, it is respectfully submitted that the disclosure of Koike cannot compensate for the above-described deficiency of Nagasaki. The independent claims from which claims 4, 27, 45, 56, and 120-129 depend recite a nitrogen containing insulating layer in contact with the substrate and beneath the photogate. Koike does not suggest a nitrogen containing insulating layer. For this reason alone, claims 4, 27, 45, 56, and 120-129 are allowable over the asserted combination.

Because Koike does not remedy Nagasaki's deficiency associated with the use of silicon nitride or other nitrogen containing insulating material, it cannot be construed as also

teaching any of the structural configurations set forth in claims 120-129. Claims 120-129 recite a “gate stack over [a] substrate and beneath [a nitrogen containing] insulating layer.” Nagasaki does not teach an insulating layer over any structure that can be comparable to a gate stack.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 4, 27, 45, 56, 125-134 and 140-144 under § 103 are respectfully requested.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki, with Suzuki

Claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the acknowledged prior art (Figures 1, 2, pages 1-12) and Nagasaki, further considered together with Suzuki.

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Furthermore, it is respectfully submitted that the disclosure of Suzuki cannot compensate for the above-described deficiency of Nagasaki. The independent claims from which claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 depend recite a nitrogen containing insulating layer in contact with the substrate and beneath the photogate. Suzuki does not teach the use of a nitrogen containing insulating layer at the location claimed as opposed to a silicon oxide layer. For this reason alone, claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 are allowable over the asserted combination.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 under § 103 are respectfully requested.

35 U.S.C. § 103 – “Acknowledged Prior Art,” Nagasaki, Okada, and Anagnostopoulos

Claims 1-4, 7-15, 18-23, 25-29, 31-39, 41-63, 65, 66, 115-124, and 135-139 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the acknowledged prior art (Figures 1, 2, pages 1-12) and Nagasaki, further considered together with Okada and Anagnostopoulos.

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would not have been obvious

because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Furthermore, it is respectfully submitted that the disclosures of Okada and Anagnostopoulos cannot compensate for the above-described deficiency of Nagasaki. Even if Okada teaches ONO, Okada does not teach or suggest the structure claimed. The independent claims from which claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60, 61 and 65 depend recite a nitrogen containing insulating layer in contact with a substrate and beneath a photogate. Neither Okada nor Anagnostopoulos, however, teaches Applicant's claimed nitrogen containing insulating layer in contact with a substrate and beneath a photogate. For this reason alone, the rejected claims are allowable over the asserted combination.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-4, 7-15, 18-23, 25-29, 31-39, 41-63, 65, 66, 115-124, and 135-139 under § 103 are respectfully requested.

35 U.S.C. § 103 – “Acknowledged Prior Art,” Nagasaki, Okada, Anagnostopoulos, and Koike

Claims 125-134 and 140-144 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the acknowledged prior art (Figures 1, 2, pages 1-12) Nagasaki, Okada, and Anagnostopoulos, further considered together with Koike.

The rejection is respectfully traversed. For all of the reasons identified above, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

It is respectfully submitted that the disclosure of Koike cannot compensate for the above-described deficiencies of the other applied references. Applicant's independent claims from which claims 125-134 and 140-144 depend recite a nitrogen containing insulating layer in contact with the substrate and beneath the photogate. Koike does not suggest Applicant's claimed nitrogen containing insulating layer configuration.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 125-134 and 140-144 under § 103 are respectfully requested.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully

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requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

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Version with Markings ~~to~~ Show Changes Made

In the Claims

Claims 120, 125, 130, 135, and 140 have been amended as follows:

120. (Three times amended) The imaging device according to claim 1, [further comprising a gate stack over said substrate,] wherein said [gate stack is disposed over an] first insulating layer is a layer of silicon dioxide [which is over said substrate].

125. (Amended) The imaging device according to claim 115, [further comprising a gate stack over said substrate and beneath said insulating layer,] wherein said [gate stack is disposed over an] first insulating layer is a layer of silicon dioxide [which is over said substrate].

130. (Amended) The imaging device according to claim 120, wherein each of said photogate and said nitrogen containing second insulating layer [are] is only partially disposed over [said gate stack] each of said first and second gate stacks.

135. (Twice amended) The imaging device according to claim 120, wherein said [gate stack comprises] first gate stack is a transfer gate stack and said second gate stack is a reset gate stack.

140. (Twice amended) The imaging device according to claim 135, wherein said nitrogen containing second insulating layer is disposed over a portion of said transfer gate stack.